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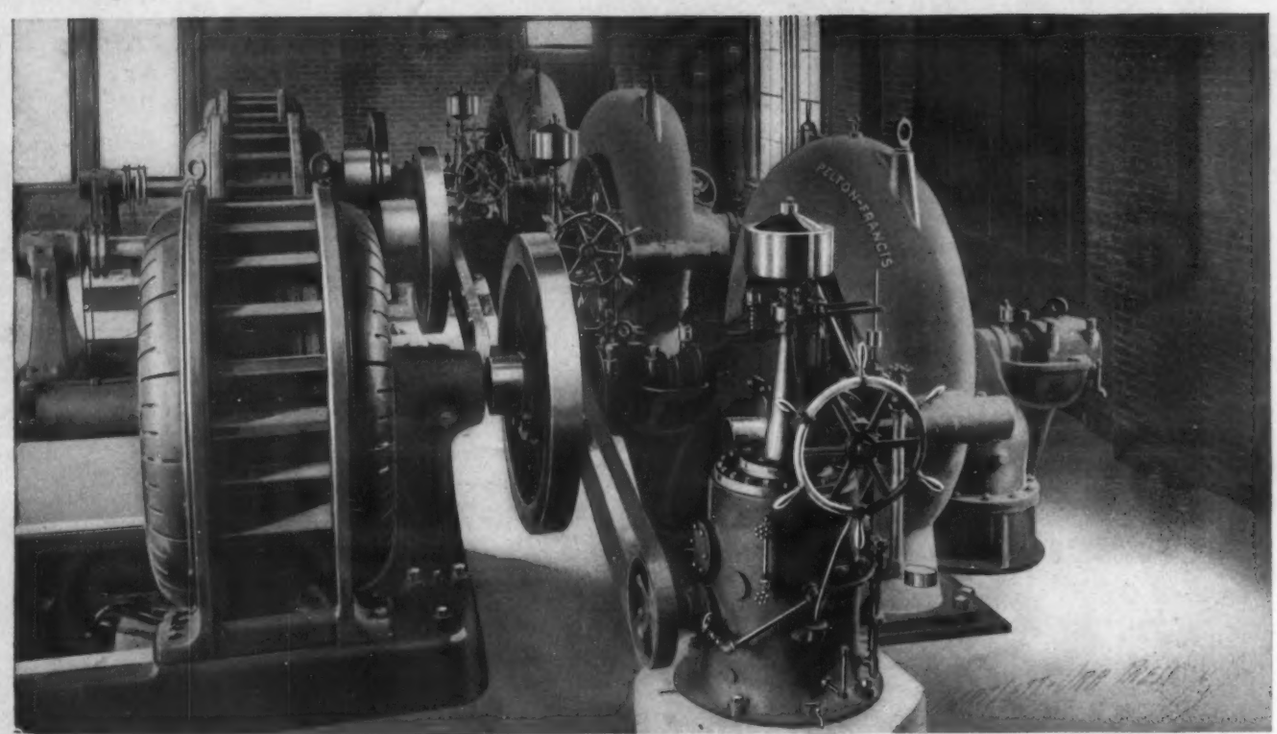

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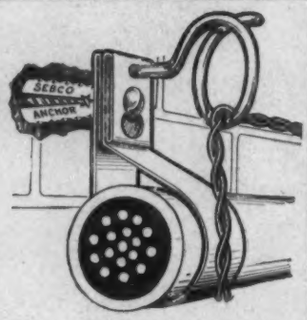

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Place	Population.
Agua Caliente	50
*Alameda	27,000
**Albany	800
††Alta	200
Alvarado	200
Amador	200
Antioch	3,000
††Auburn	2,050
Barber	200
**Belmont	600
Belvedera	350
Benicia	2,500
**Berkeley	42,000
Big Oak Flat	150
Biggs	750
Black Diamond	500
Brentwood	200
Brighton	100
Broderick	500
‡Brown's Valley	50
**Burlingame	5,000
Byron	200
Campbell	1,000
Cement	1,500
‡Centerville	20
Centerville	500
**Chico	13,000
**Colusa	2,700
†Colfax	400
Colma	500
Concord	1,500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Davenport	1,000
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Decoto	350
Dixon	1,000
Dobbins	50
Drytown	100
Durham	500
‡Dutch Flat	400
**Easton	500
**East San Jose	1,500
Eckley	20
Emerald	50
Elmhurst	2,500
Elmira	150
El Verano	100
**Emeryville	2,000
Encinal	20
Fairfield	800
**Fair Oaks	250
Fitchburg	250
Folsom	1,500
*Fresno	35,000
Glenn Ellen	500
Gold Run	100
Grafton	350
†Grass Valley	7,000
Gridley	1,800
Groveland	50
Hammonton	500
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Hollister	3,000
Ione	900
Irvington	1,000
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Jackson Gate	50
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**Oakland	230,000
Oroville	2,500
Orwood	50
Pacheco	200
**Palo Alto	6,000
†Penryn	250
Perkins	200
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**Piedmont	2,000
Pinole	1,500
Pleasanton	2,000
Port Costa	600
**Redwood City	3,500
Richmond	10,000
Rio Vista	200
‡Rocklin	1,050
Rodeo	100
†Roseville	345
Ross	900
***Sacramento	52,000
San Andreas	200
San Anselmo	2,500
San Bruno	1,500
San Carlos	100
**San Francisco	450,000
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San Leandro	4,000
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San Pablo	1,000
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Tormey	150
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Vallejo Junction	10
Walnut Creek	350
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**Woodland	3,500
Yolo	350
**Yuba City	1,900

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Service Furnished	Number of Towns	Total Population
Electricity	158	1,089,790
Gas	33	988,900
Water	17	43,415
Street Car	1	52,000

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OPERATES 11 hydro-electric plants in the mountains
3 steam-driven electric plants in big cities.
18 gas works

SERVES ⅔ of California's population
26 of California's 56 counties
An area of 32,431 square miles
3/5 the size of New York state
½ the size of all the New England states combined

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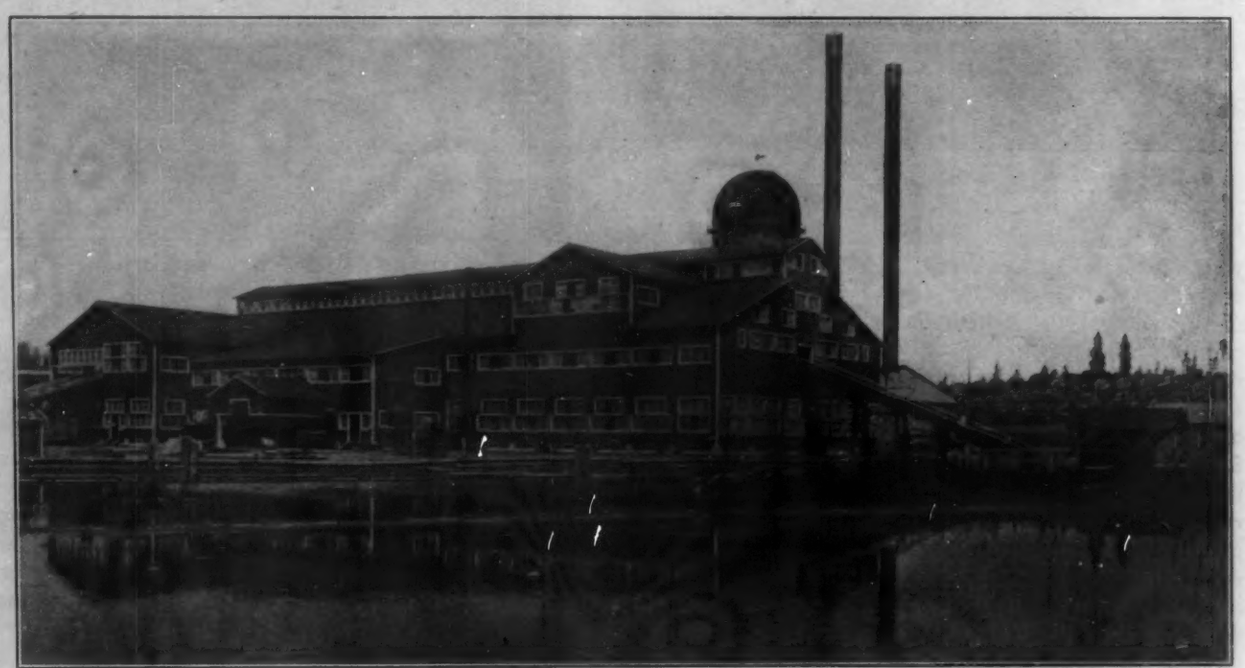
ELECTRICITY IN THE LUMBER INDUSTRY[1]

BY EDWARD J. BARRY.

The adoption of electricity for power in the lumber industry of the Northwest is of comparatively recent date although conditions are peculiarly favorable to its use. In the greater number of instances power can be generated locally at a cheap rate by utilizing the waste products as fuel. These waste products have, so far, little commercial value and in the past any fuel in excess of the quantity required for the steam units and auxiliary machinery has been conveyed to a burner and destroyed. Saw mills, as a rule, are situated in remote and sparsely settled districts where the problem of transportation to markets where the by-products of sawdust, shavings and inferior slab wood could be used, makes it scarcely worth while.

The generation of electricity for power offers a method of conserving this wasted energy by opening up a wide field for its application to the many demands for power outside of the sawmill itself. A brief record of the use of electricity in the mills of the Potlatch Lumber Company at Potlatch and Elk River, Idaho, illustrates these conditions. The Potlatch mill with a daily capacity of 750,000 feet, is one of the largest in the West and the power demand increased beyond the capacity of the steam units which consist of a 1500-h.p. Corliss engine, belt-connected to line shafting, for the sawmill, and one 1100-h.p. Corliss engine for the planing mill.



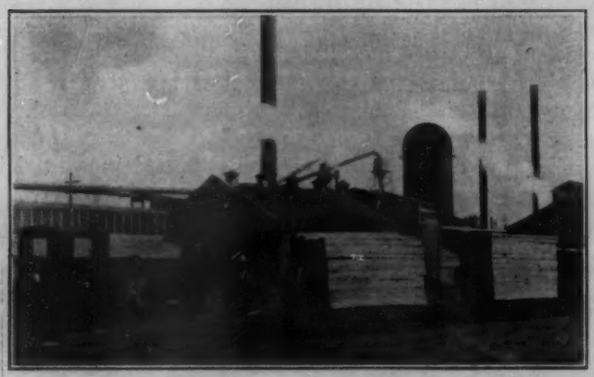
Potlatch Saw Mill.

A year ago one 800-kw. low-pressure, 2200-volt, three-phase, 60-cycle turbine generator was added to operate on the exhaust of the 1500 h.p. engine and has increased the available horsepower output by 60 per cent.

The turbine can also be operated on live steam if necessary in the event of a shut-down of the Corliss engine.

[1] Paper presented at the Pacific Coast Meeting of the American Institute of Electrical Engineers, Los Angeles, April 25-28, 1911.

The output of this 800-kw. set is used to drive the machinery in the box factory, a 300-h.p. motor driving the blower on the sawdust conveyor; it supplies power for the machine shop, car shop and pump house; lights the mills and town at night, and during the summer months supplies 200 h.p. to a local brick-making plant. No increase in boiler capacity has been required and operating conditions are such as to occasion little extra expense in the way of attention. Storage battery locomotives are employed to handle the lumber from sawmill to dry-kiln and from dry-kiln to planing mill. These locomotives are seven tons in weight, including battery, and have a start-draw-bar pull of 3600 lb., and a running draw-bar pull of 1500 lb. at four miles per hour. Two 40-kw. belt-driven units are installed for charging the six locomotives employed. Four spare batteries are kept in reserve and can be placed in position on the locomotives in a few minutes in the event of a battery failing.



Transportation of Lumber From Mill to Yard by Electric Storage Battery Locomotive.

Snow has given considerable trouble in former years through blocking the tracks and this winter there was designed and put into service an electrically-driven snow brush which has proven eminently successful. The brush consists of a wooden cylinder with rattan canes projecting 16 in. (40.6 cm.) from its surface. This cylinder is driven by a chain geared to a 15-h.p. compound-wound motor mounted on the forward part of a lumber car, the battery for driving it being in the rear. Ater a heavy fall of snow this rotary plow is sent over the tracks clearing them completely and allowing work to proceed without interruption. Lead batteries are at present in use on the locomotives but nickel-iron batteries have been ordered and it is intended to change over to this type as circumstances permit.

When it was decided to adopt electric drive for the Elk River mill, at present under construction, a complete test was made to determine the horsepower required to drive the different machines in the mills.

The machines under test were disconnected from the line shafting and belt-connected to a motor of the estimated horsepower. Wattmeter readings were taken over a period of ten hours on normal load and from this data the necessary information was obtained.

The band mills were found to take from 30 h.p. at no load to as high as 275 h.p. on full load, and it was decided to install 200-h.p. wound-secondary motors for use at Elk River. There are three motors of this type.

The edgers have 75 and 50-h.p. squirrel cage motors, respectively.

The planers in the planing mill are driven by 75-h.p. motors. In cases where it was considered desirable, liberal use has been made of wound-secondary motors.

The power equipment at Elk River consists of one 800-kw., 600-volt, three-phase, 60-cycle turbo-generator and one 500-kw., turbo-generator. A switchboard of eleven panels installed in the turbine room, controls power and lighting feeders to the different departments. For lighting the town and outlying districts the voltage is stepped up to 2200 volts, with 2200-220-100-volt step-down transformers at centers of distribution.

A 50-kw., 600-220-100-volt transformer is used for sawmill lighting, and in the event of a burn-out provision has been made at the switchboard for connection to the steam exciter set, which can be switched

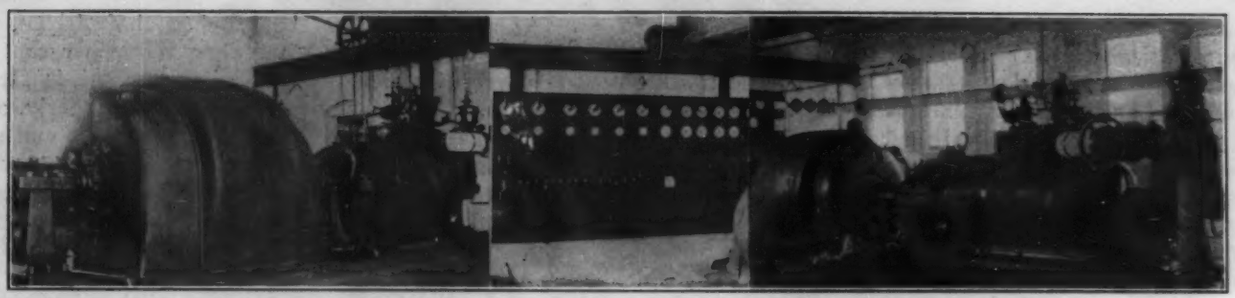
Elk River Mill and Power Station.

over for this work alone. The 25-kw. motor-generator exciter set can then be used for both generators.

A 50-lamp regulating transformer is used for the series arc system on the log pond and for street lighting in town. The sawmill is intended to run nightly, thus making the question of lighting one of importance. This is especially so in lumber grading which calls for powerful, evenly distributed light, with an absence of shadows. Experiments made at Potlatch have convinced us that tungsten clusters and single drop lights give the best effects and in the end cost least for maintenance. Arc lamps inside the mill have been discarded entirely. In the filing room, the saw sharpeners and stretchers are driven by individual motors of two and three h.p. and the small forge has a motor-driven blower. The entire system, both power and lighting, is installed in conduit, reducing the fire risk to a minimum.

Electricity will be used on the log pond for dredging, as the pond bed has a tendency to silt up and impede the passage of logs to the conveyor.

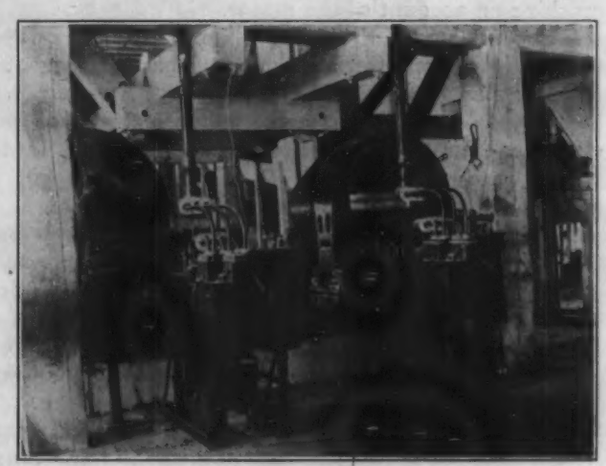
It is intended to use a rotary cutter directly in front of the intake of a powerful pump and convey refuse to the shore over pontoons supporting the pipe line. The pump and cutter will operate from a barge to which the supply wires to the transformer will be attached. The voltage will be stepped down from



Switchboard. 500 kw. and 800 kw. Turbines. at Elk River Plant.

2200 to 440 volts at the motors, and three cable drums will pay out or haul in the wire according to the location of the dredge. It has been decided that a 35-h.p. motor will be required for the pump and a 25-h.p. motor for the cutter. If necessary a small motor may be installed for raising or lowering the arm supporting the intake pipe and cutter.

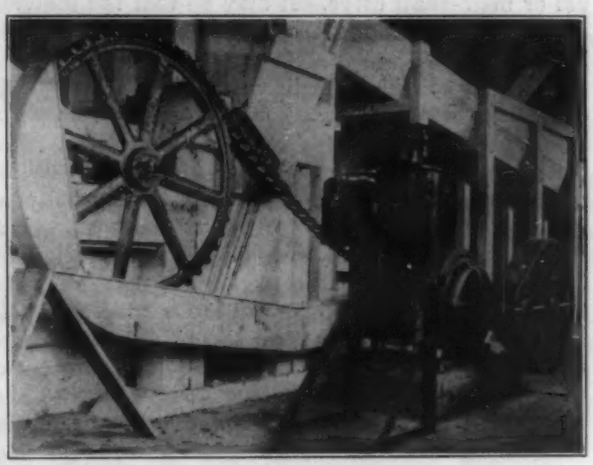
As soon as weather conditions permit the Potlach Lumber Company intends to experiment with electric drive on the logging machines in the woods, with the view of superseding the steam donkey engines at present in use. There are many drawbacks to the use of steam engines, not the least of these being the ever present risk of fire from cinders and sparks. Every care is taken to minimize this risk but the wholesale devastation in the forests of Idaho, Washington and Oregon last summer has naturally turned the attention of lumber companies operating in the fire areas,



Two 200 h.p. Motors Driving Band Saws.

towards any method which offers even a partial solution of this difficulty. Water for the boilers must be hauled wherever the donkey engines are located as it is useless to depend on getting it locally except in the rare instances where a stream is within reach. Fuel has to be cut down and sawn into the proper lengths, creating a considerable labor item. A watchman has to be on duty every night during the winter to keep the water from freezing, an occurrence more frequent than desirable, when it comes to starting up in the morning.

Electric logging presents one or two new features in transmission work, the chief difficulty being that the location of the consuming end of the line must, of necessity, change constantly. The transmission line must be guarded against the danger of falling trees, but as it will be always in the rear of logging operations it will be possible to follow the track over logged off land, reducing the risk to a possible interruption, in hilly country, through a tree rolling down from higher ground. When a section has been logged over and a permanent change has to be made in the direction of the transmission line it would appear that a saving could be effected by installing light lattice work steel towers in the first instance. The towers could be set down and guyed to convenient stumps. The line would parallel the logging railroad practically throughout its entire length and when it was necessary to change the location these towers could be taken down and loaded on the cars. The wires and insulators would have to be removed in any case and, as the construction crew will be on the spot, it would take little extra labor to remove the towers also. The length of span will be from 350 to 400 ft. and the



Chain Driven Conveyor and Starting Apparatus for Wound Secondary Motor.

height of tower from ground 30 ft. The size or character of the wire will not be settled definitely until the nature of our requirements is known. The current will be 22,000-volt three-phase, 60-cycle. At each logging engine there will be a portable sub-station containing one 150-kw., three-phase, 22,000-550-volt, step-down transformer. From the secondary of the transformer a three-core steel-armored flexible cable will be led to the motor. This cable will be built up in sections with suitable connectors until a limit of 1800 ft. is reached, when it will be necessary to extend the line. This distance will permit of clearing a large area, as the steel logging cable has an effective reach of 3000 ft. The motor will be of 150 h.p. capacity, and of the phase-wound type driving by means of friction pulleys.

A controlling panel with current-limiting relay to automatically introduce resistance into the rotor circuit in the event of the log striking an obstruction, will be installed on the platform beside the motor. This principle has been applied with success on electric shovel work and prevents the annoyance of a constantly tripping circuit breaker. A circuit breaker will be used to prevent damage to the motor should the power demand rise to an excessive value in the event of the obstruction proving beyond the capacity of the machine.

If successful there is scarcely a limit to the uses of a power supply carried into the forests and the natural outcome would seem to point to an extension embracing a complete electrification of logging railroads. Within four miles of Elk River there are two waterfalls of 85 and 102 ft. (25.9 and 31 m.) respectively which could supply upwards of 5000 h.p. There are numerous little settlements at present remote from any center of power supply, which doubtless would welcome the opportunity to secure energy to assist in development.

MOTOR DRIVE VERSUS LINE SHAFT.

BY H. P. PITTS.[1]

The tendency of modern shop equipment is toward individual motor drive. That is, having a separate motor for each individual machine, driving it either by gear, chain, or belt. There is a question whether all points are considered when deciding between individual or main-shaft drive. It may be that the individual motor, like our modern card index system, is just a little overdone.

Let us consider the line shaft. In the first place ordinarily too little attention is given to this part of the equipment. In the machine shop the highest priced machine tools are operated by the most skilled machinists. The shafting is in the care usually of a laborer whose duty it is to "oil up" once a week and to let it go at that; he knows nothing about alignment, is apt to pay no attention to the fact that the timbers to which the hangers or bracket boxes have been bolted have become twisted or have shrunk, leaving the nuts loose, and that the shaft becomes out of true, due to these apparently small matters. The overhead shafting should have careful attention, inasmuch as it is sometimes said to utilize thirty per cent of the power required for the shop. The writer recently in discussing this matter with a well known shop superintendent in San Francisco was informed that the greatest precaution was taken and care given to minimize the losses in the shafting in his shop, so much so that every morning at eleven o'clock a skilled machinist was employed to go over the line shafting and countershafting thoroughly, taking temperature of bearings and using a pointer gauge against the shaft to determine whether or not it was running true. If anything was found requiring attention it was repaired during the noon hour. This is a very wise precaution and could be instituted by every works where shafting is the driving element. The result is that the starting current on the motor is reduced to a minimum and the piece of apparatus that is supposedly taking thirty per cent of the power is kept in as good shape as the lathe operated by the most skilled mechanic.

[1]Industrial Engineer Pacific Gas & Electric Co.

As a rule machine shops, when shaft-driven, require for their operation less than thirty per cent of the power at which the individual machine is rated. Therefore, if the machines are classified properly, and the line shaft is cut up into sections, and we will say ten or fifteen machines driven from each, a motor of one-third the capacity of the sum of the full load requirement of each machine will do the work and give a high line shaft efficiency. This is due to the fact that not one-fifth of the time is a machine taking its full driving capacity, notwithstanding that it may be in operation nine-tenths of the time, for the reason that part of the time is taken to set the piece of work up on the machine, and part of the time in taking finishing cuts, polishing, and so on. Now these fifteen machines are never doing the same operation at the same time, hence the motor has a chance to equalize itself.

Let us consider the individual drive. First of all a machine to be properly equipped should have a motor equal to the capacity of work that the machine will be called upon to do. No other machine is going to help it out. If an overload is thrown on it (and motors are not built these days to carry an overload very long) the motor will drop in speed. In other words, the machine cannot do more work than the motor will drive. If a new steel tool be put on the market whereby increased speed may be used (and the machine shop practice has been revolutionized in this respect in the last ten years) a higher duty cannot be had from this machine on account of the motor.

Second, under these conditions one is compelled to buy fully three times the motor capacity. And that is quite an item at $12 a horsepower. Nothing is to be gained in space; in fact, countershaft-driven machines are more compact as to floor space. Under either condition all tools of the same class will be grouped and as closely as possible.

Modern shops have their wires in conduits in concrete floors. For the individual drive more conduits will be required. Especially is this last feature objectionable in cases where the individual drive class of machine has to be moved and set up in a different place, and such things are not uncommon. It will never be located just right for the conduit connections. It will mean digging into the concrete and extending the leads. There is another feature of no small importance. A good talking point in this class of motor drive is that the motor is idle when the machine is stopped. But it must not be forgotten that the starting current of these motors runs into two hundred to three hundred per cent of the operating load. The starting current is going on at a diminishing rate, however, while the motor is accelerating. Shaft-driven machines accelerate much faster. It cannot be said to be an argument against shaft-driven machines that they take up room overhead. There is always lots of room overhead; it is the floor space that counts. The cost of belting will not be a much larger item than the gear, link-chain, or belt-drive of the individual drive.

It is not the object of this article to discredit the individual drive (there are places where it is almost indispensable), but to draw out a few points to be considered when a man is almost persuaded to buy three times the motor capacity he really requires.

OIL BURNERS.

BY M. C. LORD.

We will take up the different phases of oil burners, dealing with the most important (atomization) first.

The gravity of oil from different fields varies from 12 to 32; in the California oils 12 being a heavy semi-solid substance in cold weather, and even some of the lighter oils will not flow freely in cold weather. This necessitates that steam pipes be led into the tanks in order to get the oil to flow to the pumps; which should be located as near the oil tank as possible.

An objection to heating the oil in the tank is that it gives off gas which causes the pump to lose its priming. This is corrected by some builders by means of an air chamber connecting over the suction valves on the pump to take up the gas which would otherwise pass to the burner and cause irregular action, from which more "flash backs" occur, than from any other cause.

The oil is further heated by discharging into a receiver connecting to the burner, and heated by a steam coil led into it, to further liquify the oil and assist in atomizing.

Of the some ten thousand burners on the market, none of them with the use of any agent (steam or compressed air) atomize the oil perfectly, and the majority of burners depend on forcing the oil through a small orifice in order to bring the greatest number of particles of oil in contact with the atomizing agent. The hair or stringy particles of oil soon pile up in the orifices and clog the burner.

The external method of mixing the oil and the atomizing agent at the tip of the burner or by means of small holes near the tip, increase this difficulty.

The internal method of mixing inside the body of the burner by small orifices makes the matter more difficult because an increase of the pressure does not as readily blow out the obstruction as would be the case if the smallest section of the burner was at the tip.

The proper solution of the difficulty appears to be in diverting the direction of flow of the oil several times in the body of the burner while mixing with the atomizing agent; thus avoiding the passing of the oil through small orifices, which readily clog up. Where steam is used as the atomizing agent, to which there is no great objection where water is plentiful, more air has to be admitted and a great deal of fuel can be wasted, even when the fire does not show it to the practical eye, if there is not the proper amount of air admitted at the proper place.

Frequently it is advisable to remove a couple of bricks from either side of the furnace, and admit air on either side of the bridge wall at its base, where it will strike the most active point of combustion. Too much air is almost as bad as not enough. It takes oil to heat it and as four-fifths of the atmosphere is a non-combustible gas it is an expensive waste of fuel. The proper method is to analyze the smoke-stack gases and increase the air until they show a little escaping oxygen.

A great many oil burners have been condemned from improper installation, and boilers ruined from improperly built bridge walls that deflect the flame against the boiler, which is so intense as to drive the water away from that part of the sheet, and blistering results.

Bridge walls are an important factor, and should be built with a view to getting an even distribution of heat as near as possible over the entire heating surface of the boiler. A few pounds of salt mixed with the fire clay and used as a grouting to spread over the brick will prolong the life of the bridge wall as it will form a glaze that the fire will not affect. Retarders placed in the tubes are objectionable because they lessen the draft and intensify the heat in the firebox where it is the greatest, decreasing the life of the boiler accordingly.

A burner which will show the best results under one type of boiler with a light oil, may not operate at all satisfactory, using a low gravity oil, for the burner may keep clear and the flame be such as to give a good heat distribution with a light oil, and in attempting to use a heavy oil get poor results. Hence we see a burner used successfully for a year or more and then be displaced by another type when the company signs a new oil contract.

The first requirement is an even distribution of heat over the entire heating surface of the boiler, which may be accomplished by an external atomizing burner using 25 gravity oil (which is a light fuel oil) in a water tube boiler distributing the flame moderately well. But if we attempt to use 14 gravity oil in the same burner, we will find a pyramid of carbon piling up in front of the bridge wall which must be removed.

This carbon means so much of the best of the fuel wasted and it may pile up sufficiently to injure the boiler by diverting the flame to one spot, which we find to be frequently the case where heavy oil is used by an external atomizing burner, as the oil reaches the point of atomization in globules, and a great part of it is blown off in a solid mass, part of which burns, the balance forming a pyramid in the furnace except part of the latter which pass up the smoke-stack in the form of free carbon.

Small pieces of semi-solid matter lodge in the slits or holes in the tip of the burner and if the pressure banks up in the atomizing line fast enough, will blow out in a solid mass to be partially consumed unless they choke the burner and put the fire out, when there is a good chance for some one to get severely burned, in which case I might mention that cylinder oil, or even the crude oil itself is a very good remedy to apply to the burns.

Where oil below 18 gravity is used, pre-heating is necessary to get good results. When we are confronted with the problem of getting rid of the asphaltum which will be deposited on the walls of the pre-heating chamber, the easiest method to overcome this difficulty is to fit the chamber with a removable sheet iron lining which can be taken out by placing a removable head on the pre-heating chamber when it can be thrown in the furnace and the asphaltum burned off readily.

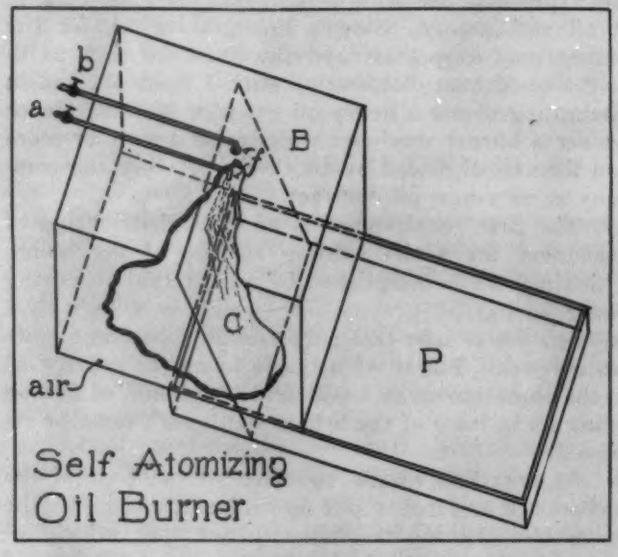
The oil burning problem has interested more inventors in the last few years than most anything else, but there is still a well-earned reward for the man

who can invent a burner which will atomize all the oil that passes through it.

A serious problem in small isolated plants is the getting up of sufficient pressure to atomize the oil in starting fires. Some plants install small boilers which are fired with wood until they get sufficient pressure to operate the burners under the main boilers. This is additional expense and loss of time.

The writer devised a self-atomizing burner some four years ago and a description of the same may be of interest to some isolated engineer as the entire burner can be easily made on the job.

Fig. 1 shows the burner complete, which can be made from a casting or sheet iron will do as it will be in use only until steam pressure is high enough to run the atomizer.



A pan of cast sheet iron partially covered by the box B, contains the plate C placed directly in the furnace door. Sufficient oil and waste is placed in the pan P to come up to the point D and is ignited; the flame passes up in the box B heating the plate C and, as soon as the plate C is hot, cold water is turned on at b, dropping on the hot plate through the hole f in box B. Immediately the water strikes the hot plate it spreads over the surface and the oil turned in from the pipe a, dropping on the film of water confines it on the plate C where it generates steam, making a miniature explosion, which passes through the surface of the oil, atomizing it and giving a hot fire which soon raises steam.

A new aluminum alloy is described in a paper recently read before the Birmingham branch of the British Foundrymen's Association. The result of adding aluminum to copper causes an immediate increase both in the strength and in the ductility of the copper, the ductility attaining a maximum at 7.35 per cent aluminum. Beyond that it fell, and when 11 per cent was reached the alloy became too brittle to be of any commercial value. Heat treatment had little effect upon alloys containing less than 7.35 per cent aluminum. Beyond that they were stiffened by heat treatment at 800 degrees C. Alloys containing less than 7.5 per cent aluminum were not amenable to cold working, though they were improved by hot rolling.

THE COMING CHICAGO CONVENTION OF AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Unusual interest is taken in the forthcoming annual convention of the American Institute of Electrical Engineers, for it will be held in Chicago on June 26 to 30, inclusive, and it has been many years since the convention met in that city, although the electrical attractions of Chicago and vicinity are exceptional in interest and variety. Among these points of interest may be mentioned the Ryerson Physical Laboratory of the University of Chicago, where the atomic theory of electricity has been demonstrated by most interesting experiments; the electric furnaces in the steel mills at South Chicago; the enormous electric plant at the Gary, Ind., steel works, driven by gas engines; the great central stations of Chicago, famous for their size and modern design; the hydroelectric development of the Chicago Drainage Canal; "Underground Chicago," with its network of electrically operated freight tunnels; the latest large automatic telephone system; several of the largest manually operated telephone exchanges in the world; street railway and other substations of unusual interest; possibly the largest street railway shops in the world, with electric drive throughout.

The convention will meet in the new Hotel Sherman, the most recently completed of Chicago's group of modern hotels. The sessions will be held in the handsome Louis XVI room, which will seat 700 people and can be connected with adjoining apartments to seat 1500 if desired.

While the list of papers to be presented at the convention is not complete, the following partial list of papers that will probably be presented shows the diversity of subjects to be considered: "Economical Design of Direct Current Magnets," by R. Wikander; "Catenary Span Calculations," by W. L. R. Robertson; "Currents in Inductors of Induction Motors," by H. Weichsel; "Multiplex Telephony and Telegraphy by Means of Electric Waves Guided by Wires," by Major G. O. Squier; "Electrolysis in Reinforced Concrete," by C. E. Magnusson; "Induction Motor Design," by T. Hoock; "The High Efficiency Suspension Insulators," by A. O. Austin; "The Electric Strength of Air,' by J. B. Whitehead; "Electrification Analyzed, and Its Application to Trunk Line Roads," by W. S. Murray; "Telegraph Transmission," by F. F. Fowle; "The Cost of Transformer Losses," by R. W. Atkinson and C. E. Stone; "The Costs of Railway Electrification," by B. F. Wood; "Induction Motor for Single-Phase Traction," by E. F. W. Alexanderson; "Magnetic Properties of Iron at 200,000 Cycles," by E. F. W. Alexanderson; "Electric Storage Batteries," by Bruce Ford; "The Characteristics of Isolated Plants," by P. R. Moses; "Elevator Control," by T. E. Barnum.

A committee of fourteen local members of the Institute has been appointed to make the arrangements for the convention. Mr. Louis A. Ferguson, 120 West Adams street, Chicago, is the chairman of this committee. The program will include visits to points of interest and various social events, and it is confidently expected that the 1911 convention of the Institute will be the most successful in its history.

A CURIOUS FORM OF CONTRACT.

The accompanying contract is the basis upon which a 75 kw. electric power plant has been installed at Papeete, whose streets had heretofore been lighted with oil lamps. The street corners are lighted with 100 c.p. incandescents. 40 c.p. bulbs being used elsewhere, and also being used after 11 o'clock. Consul North Winship reports that "the natives stand and gaze at these wonderful new lights by the hour, and many long voyages are made by the curious inhabitants of neighboring islands just to have a look at the brilliant city." In addition to this 3000-light plant, the owner operates 74 telephones on the island and maintains a wireless telegraph station.

Papeete, 28th December, 1910.

To the Mayor of the City of Papeete, Tahiti:

Worshipful Sir:—I have the honor to submit the following proposition for the extension of the electric lighting of the city, which has already been in use for several weeks, but which cannot be extended to include all the streets and places unless the municipality engages to maintain this mode of lighting for a period sufficiently long to justify the necessarily heavy expenses to be incurred to light the city entirely, that is to say, for a period of at least five years.

I propose lighting until 11 o'clock at night the Quay of Commerce from Fare Ute to the Manutention at the corner of the Hotel Tiari Annex, Rivoli street, from the East Bridge to the Gendarmes Barracks, Petite Poligne Street, Market Place, and the intersection of Bonnard and Collette Streets, i. e. all the center of the city, with lamps identical to those at present in use for street lighting, which light these streets so well that it would be possible at any point to tell the time by an ordinary watch.

To produce such a good lighting, which is equalled in very few large cities of the world, it would be necessary to place a lamp at each street corner mentioned.

At all the other intersections of the city streets the lighting would be done by means of lamps of half the power of those above described from half an hour after sunset until 11 o'clock at night.

At all the extremities of the streets such as following the Ramparts, and on the main road, and at Patutoa, lamps of half the power of the above would be sufficient. These last would even then be about 5 times more powerful than the actual oil lamps.

If I stipulated in this manner the power of the lamps to be used instead of speaking of their intensity in candles, or carcels, it is because these units, although they should, it is understood figure in the contract to be made, offer no base to the imagination for the luminous intensity, whereas when I undertake to light the principal streets, in such a manner as to tell the time by a watch I make clear the beauty of the lighting that I offer you, and the propositions indicated for the other lamps allow one to clearly imagine their lighting power, much better than would be the case, in mentioning the nominal candle power of each lamp.

From 11 o'clock at night all the large lamps would be put out, and replaced by lamps of the same lighting power as those on the ramparts. I estimate the total number of lamps necessarily lighted altogether to be 93, (29 large, 11 medium, 55 ordinary).

The lamps would be lighted as indicated above from half an hour after sunset until half an hour before sunrise, during 15 nights per month, all the installation and upkeep at my expense, for approximately the same price as actually costs the oil lighting, i. e. 7200 frcs. per year, on condition that the municipality assists me for the motive power with water which today runs to waste, i. e. the quantity of water which would run from an opening of 1¾ in. or 44 mm. at a pressure of 3 atmospheres from half an hour after sunset to half an hour before sunrise. If the available pressure should be increased the opening should be proportionately diminished.

To rebutt the pretensions of certain people interested to the effect that the quantity of water thus used would be so great that the city's water supply would be affected, it is sufficient to draw your attention to the tap which I have the honor to present herewith, which should serve as maximum opening to my installation and compare it with the piece of pipe attached thereto, which represents the dimension of most of the supplies in the city for which a charge of 5 francs per month is made.

Furthermore it is well to call your attention to the fact that the water plugs have a diameter of 53 mm. or a superfice half as large again as the tap of my hydraulic motor, and every one knows that these water plugs remain open often for several days at a time, the night also, without depriving the city of water. How then, would it be possible for a plug much smaller and open only during the night to do so.

But, however, the municipality would always have the option of stopping all, or part of the water, that it could supply me with, without having to give reason for so doing, only in this case, the price of the lighting would necessarily be increased in order to allow me to pay for the considerably increased quantity of combustible that would then be necessary, i. e. all decrease of pressure, of quantity or hours of water supply, would cause a simple proportional increase of price, this increase being calculated on the base that the entire withdrawal of the hydraulic power would double the price of the lighting. Also if the city supplied me with more hydraulic force than that provided for, the price of the lighting would be diminished in proportion by a rebate of 10 per cent for every 20 per cent of increase of hydraulic power supplied. This observation applies equally in the case the city supplies me with hydraulic power at other hours than those mentioned above. It would be fitting that in this manner the city should in time be lighted without cost, the supply of water entirely paying for the lighting.

I should always be held to assume the entire lighting even if the water were entirely stopped, for a determined length of time.

The 15 days of lighting per month proposed, could be advantageously divided or sectionized in such manner that the lamps would be lighted during the hours and nights when there would be least moonlight.

Furthermore if during a night which should be normally moonlight, there should be bad weather, the artificial light could instantly replace it, shutting it off again when the moon should come from behind the clouds.

The city would in this manner only have to pay as supplement for the few hours during which the electric light would have been necessary.

If however at any moment it should be found that the 15 nights or better the 15 times 11 hours or 161 hours of lighting per month, should not be normally sufficient no matter how divided between the 30 nights, of the month, the Mayor would always have the power to increase the period of lighting in consideration of increase proportional to those above.

If the additional lamps were used only in a temporary manner such as for a fete, etc., the cost of installation should naturally be supported by the city. And no derivation whatever should be made from my mains without my consent.

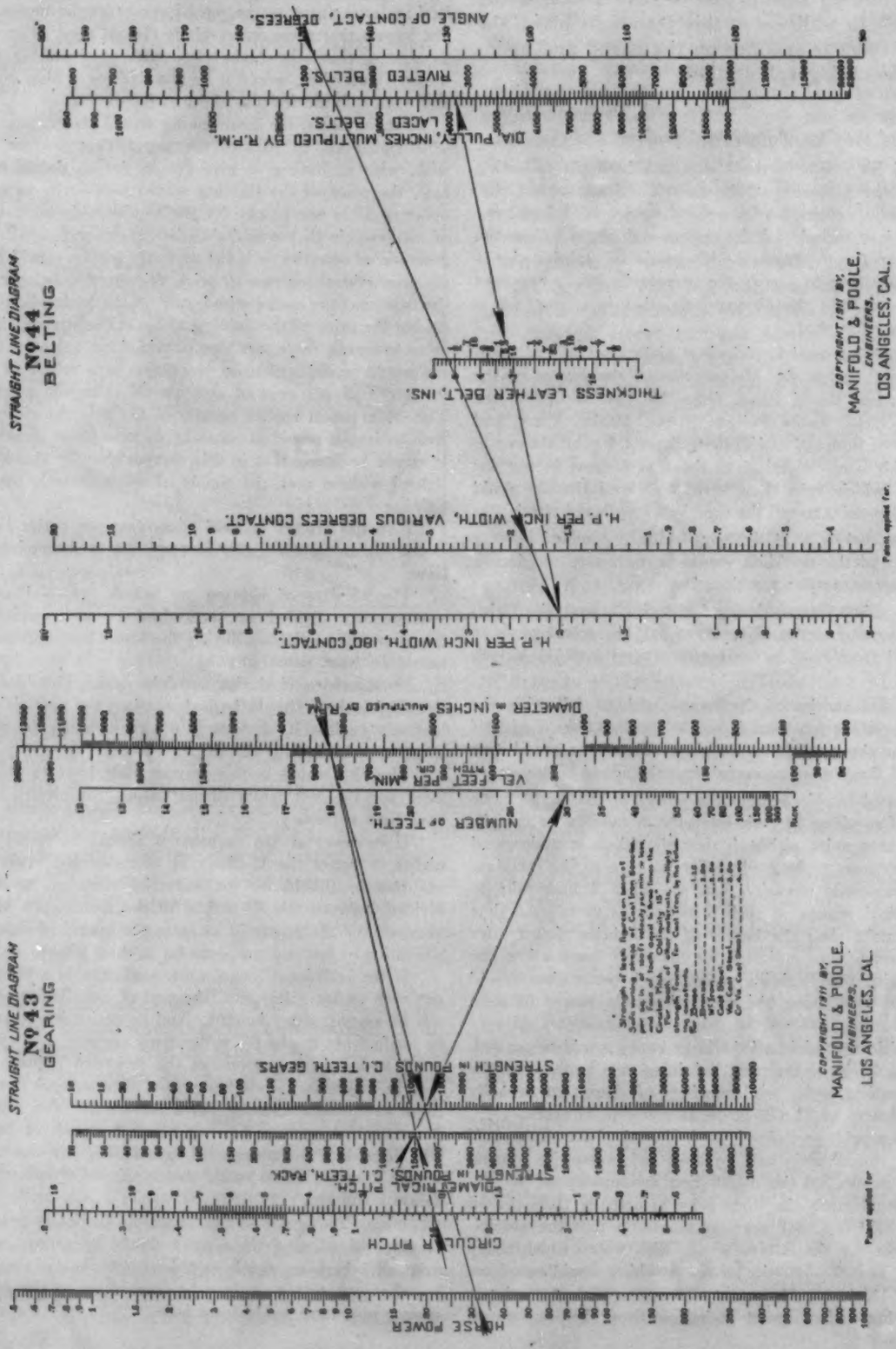
I undertake to commence the proposed lighting within two months, excepting a few lamps at a distance such for example as those at Patutoa and the Main Road, etc. For those it would probably be necessary to wait about a month or two more. I will furnish it is understood, guarantees for the performance of the contract to be made under the conditions and with the delays stipulated.

I have the honor to ask as simple justice to render me that at the expiration of the term I should be given the preference over all others on equal conditions, for the lighting of the city by whatever system it may be, according to the progress that science may have made from now. O. G. D.

GRAPHICAL SOLUTION OF GEARING AND BELTING PROBLEMS.

The accompanying straight line diagrams give a simple and rapid method of computing gearing and belting. They are used by permission of the authors from a forthcoming enlarged edition of their book on "Straight Line Engineering Diagrams." In each case the method of operation can best be understood by a typical example, the general principle depending upon the use of a string or straight edge to carry a line from a known point on one scale to a known point on another scale, solutions being found at the points of intersection on the remaining scales. The necessity of revolving the line around a point is indicated by double arrows.

Example for No. 43.—A cast iron gear has the following dimensions: Pitch 1½ in., face 4½ in., number of teeth 30, diameter pitch circle 14.32 in. What is the strength of the teeth and what horsepower will it transmit at 222 r.p.m.?



Solution: Multiply the diameter 14.32 × 222 = 3179; from this point on Scale No. 8, run to 1.5 on Scale No. 2, and find strength of rack tooth on Scale No. 4 equal to 1500 lb.; revolve index on this intersection and connect to 30 on Scale No. 6, and find strength of gear tooth 1220 on Scale No. 5; revolve on this 1220 and connect to 30 on Scale No. 6, and find strength gear toor 1220 on Scale No. 5; revolve on this intersection and connect again to 3179 on Scale No. 8, and find horsepower 31 on Scale No. 1.

Had the face of this gear been only 3 in. the h.p. would have been proportionately reduced, and would equal 31 × 3 divided by 4½, equal to 20 2/3.

It will be noticed by inspection of Scales 2 and 3 that 1½ circular pitch is very nearly equivalent to 2.1 diametrical pitch. The exact figure is 2.0944. Also by inspection of Scales Nos. 7 and 8, the diameter in inches multiplied by r.p.m. = 3179 as above, is equivalent to a velocity of pitch circle of 835 ft. per min.

Making the angle of obliquity 20 degrees instead of 15 degrees adds about 15 per cent to the strength of the gear.

Example for No. 44.—How many h.p. will a belt 5/16 in. thick and 10 in. wide transmit to a pulley 20 in. diameter, running 205 r.p.m.? Laced belt.

Solution: Multiply 20 in. diameter of pulley by 205 r.p.m. = 4100; then from 4100 on Scale No. 5 run to 5/16 on Scale No. 4, and find on Scale No. 1 h.p. per inch of belt 2; multiply by the width of belt 2 × 10 = 20 h.p. Should the angle of contact be 148 degrees, from 2 as found on Scale No. 1, run to 148 on Scale No. 7 and find 1.8 on Scale No. 2, which multiplies by the width 1.8×10 = 18 h.p.

CONSULAR NOTES ON THE ELECTRICAL INDUSTRY.

Panama.

The only electric-light company in Panama is the Colon Electric & Ice Supply Company, which has one central station and charges the following prices: For installation, $3; for connection, $1; for one 40 watt tungsten lamp, $1; for one 16-candlepower carbon-filament lamp, $0.50; for one 32-candlepower carbon-filament lamp, $1; and in addition a charge of $1.75 a month is made for each light.

The company has a five-year contract with the National Government, dating from February 18, 1909, for the electric lighting of public offices, buildings, and the streets of Colon, under which it received for service during the month of January (1911) alone $1733. This would aggregate nearly $20,800 a year; and if to this amount is added the $15,000 paid by private consumers for current, some idea of the company's annual income may be obtained. The company has a monopoly of supplying Colon with ice, which it retails at 2½ cents a pound; and in conjunction with the ice plant there are cold storage facilities from which a neat sum is realized.

West Indies.

Contracts for electric lighting have been entered into by the Colonial Government and by the municipalities of Basse Terre and Pointe a Pitre severally with a merchant in the first-named city.

The municipal contracts were made four or five years ago and contain a penalty of $1 for each day's delay after notification that service is demanded, but this notice has never been given and there are thus no arrears to be paid. The contract with the colony was approved on September 1, 1910. The merchant has no means for carrying out his agreement, and proposed to pay for construction out of earnings, but he is now willing to cede his contract to a constructing company until such company shall be completely reimbursed. Ample water power is to be had at Basse Terre, but other power would have to be used at Pointe a Pitre. The total cost of plants and lines has been estimated at $55,000 to $60,000.

France.

Electric Jewel-Box Alarm.

A useful invention in the way of a cash and jewel box with an electric alarm attachment has just been placed upon the market in Paris and has every prospect of finding a ready sale both here and in the United States, though so far as known there has been only one sample box sent to the latter country as yet. This alarm box is said to be the invention of Mr. Paul Weber, of Vienna, Austria, and is covered by patents in several countries of Europe as well as in the United States.

The invention, briefly described, is as follows: In the bottom of the jewel box is placed a small mechanism consisting of a dry battery, a magnet, and a system of levers, the whole forming a device not unlike a telegraph instrument, which may be electrically charged by moving a small lever fixed and concealed in the side of the box. The sound is made by means of a bell and clapper similar to those on a telephone instrument. In the center of the bottom of the box is a small orifice, through which hangs suspended this pendulum. As long as the box is stationary this pendulum hangs perpendicularly and does not close the electric circuit. But if moved only in the slightest degree one way or the other, or if the box is raised off the table, the pendulum drops down, thus closing the circuit of the electrically charged mechanism and causing the alarm to sound. It makes a noise as loud as an alarm clock and does not cease ringing until it is "shut off." This can only be done by opening the lid of the box and shifting a lever. It would therefore be a noisy article for a would-be thief to attempt to steal.

Germany.

In a recent debate it was brought to the attention of the Reichstag that there are in Germany at present only three great groups in the electrical industry—the General Electrical Company, the Siemens-Schuckert Company, and the Bergmann-Elektrizitaetswerke.

It is rumored that efforts are being made to bring about a fusion of the Siemens-Schuckert and the Bergmann interests. The relations of the General Electrical Company and the Siemens-Schuckert people are already close, consisting of agreements relative to certain classes of products, important contracts, etc. The fear was expressed in the Reichstag that sooner or later the three companies would join forces and form a monopoly at whose mercy would be not only private consumers, but also the Government, which will be a heavy user of current for its electric

railways. These concerns manufacture every description of electrical supplies, and in addition install electric plants. By reason of their enormous capital they can finance the plants which they put up with their own products, engineers, etc. Their contracts not infrequently contain a clause binding the other parties to purchase supplies only from them.

In addition to these great companies there are numerous small concerns that manufacture one or two kinds of electrical supplies and together employ some 60,000 workmen. Further, there are in every city small firms which install electric lighting, etc. The necessity of protecting these less powerful factories and concerns was brought to the attention of the Reichstag.

Sweden.

A considerable increase was made during 1910 in the amount of water power utilized for the generation of electricity; 21 new power stations, representing an aggregate of 103,530 horsepower, were completed.

Of this amount, 40,000 horsepower is represented by the State installation at Trollhatten, in the Gothenburg consular district, already the seat of extensive electric plants. The remaining 63,530 horsepower is represented by 20 private plants located in various parts of Sweden. It is stated that new installations now under construction will add 115,000 horsepower to that which was available January 1, 1911. Of this amount the Government station at Porjus will produce 50,000 horsepower and seven private plants the remainder. Five older stations, representing 7650 horsepower, were rebuilt in 1910.

The municipal electric power station in Gothenburg secures part of its current from Trollhatten and generates the balance here in a steam-operated plant. Both alternating and direct current are furnished, the rates per kilowatt hour being 38 cents for lighting, 6.7 cents for lifts and elevators, and 4.8 cents for motors and power. The total amount of electric power brought to and produced in Gothenburg in 1910 (by the public service, excluding private plants) aggregated 16,211,593 kilowatt hours, of which 12,023,839 came from Trollhatten and 4,187,754 were generated in the steam plant. The aggregate loss of energy amounted to 2,424,714 kilowatt hours, or 14.95 per cent.

The uses to which the net power was put were: Greater industries, 5,185,928; street car lines, 4,165,277; harbor cranes and derricks, 53,678; Trollhatten power station, 18,630; private lighting, 2,409,002; private motors, 1,453,566; public lighting, 163,615.

HIGH SPEED DIFFICULTIES.

BY H. G. REIST.

The author of this paper, which was part of an address at the Clarkson School of Technology, is designing engineer with the General Electric Company. His talk was concerned with some of the problems of the electrical engineer from the viewpoint, not of the operator, but of the designer.—Editor.

The high speeds of the steam turbine, as compared with the lower speeds of the reciprocating engine, have introduced several difficulties, including great mechanical stresses and difficulty of balancing. The high speed is necessary because to get the best results, the velocity of the periphery of the turbine wheels must have a certain relation to the speed of a jet of steam as it issues from an orifice. The maximum velocity of steam coming from an orifice, with a pressure used ordinarily in boilers, say about 150 lbs., is about 4000 feet per second, or about 45 miles per minute. The highest efficiency in a steam turbine with one wheel would be attained if the speed of the periphery of the wheel was about equal to one-half of the speed of the jet of steam, but we do not know of any way of building a wheel that can run at one-half the speed of a jet of steam, since the centrifugal stresses in the wheel become so great that any metal that is available for the construction of turbine wheels would fly to pieces. We must, therefore, be content to run at a lower speed and a lower efficiency. By passing the steam through two wheels, the wheel velocity may be greatly reduced and still give good efficiency. A further reduction in speed and an increase in efficiency may be made by taking a part of the energy out of the steam on the first wheel; then allowing the steam to come almost to rest and starting it over again through a second nozzle against a second wheel and repeating the process, in some cases three or four times. This produces a multi-stage steam turbine, and enables us to obtain quite a high efficiency at speeds that are safe with the materials available for the construction of the rotating parts.

Steam turbines are generally used for driving dynamos. It is easier and better to connect a dynamo directly to the shaft of the steam turbine than to belt it; and so it follows that dynamos must be built for the turbine speed. Before we had to bring the speed of the dynamo down to match the engine speed at a considerable inconvenience. Now, because the steam turbine runs so very fast, we must make electric generators that run faster than we like to run them.

The electric generator, or dynamo, is a complex machine, being built up of a large number of parts of thin iron, of copper wire and of insulating materials. The insulating materials consist of varnished cloth, paper and mica. All these materials are of a soft and yielding nature. This makes the problem of holding them together without injury, a difficult one when high speeds are encountered. The centrifugal forces are so great on the surface of the rotors that each pound of material must be held with a pressure of 4000 lbs. to keep it in its place. A piece of copper wire must be held every inch of its length else it will be bent and deformed. If it is unsupported at any space along its length, it will bend into that space almost as though it was putty. The speed of the outside of the revolving part of a dynamo driven by a steam turbine in some cases is more than 20,000 feet per minute, that is, over four miles. Some parts of the generator do not have sufficient strength to hold themselves and must be held by bands of steel. A band of steel an inch square in section around some of the revolving parts would be strained to nearly 12,000 lbs. to hold its own weight. In many places parts not capable of holding themselves must be supported. It must be done by material that has considerable strength after holding its own weight. For this reason materials

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AN AFTERMATH OF NATIONAL ELECTRICA

DEL MONTE, CALIFORNIA, APRIL 2

ELECTRICAL JOBBERS' CONVENTION.

ORNIA, APRIL 25-6-7, 1911.

of more than ordinary strength must be used. All rings of metal must be put on the shaft firmly because when they rotate, they enlarge, due to the centrifugal stresses, and if they are not shrunk on with considerable elongation in the first place, they will become loose. To avoid this, the parts must be put on so tightly that the metal will be stressed more than the stress that will be produced by rotation. If this is not done, the ring will stretch enough to become larger than the shaft and will be loose. This would cause trouble with the balance. One time it would be touching on one side of the shaft and then on the other. This would cause the machine to shake badly and parts of it would wear rapidly.

One of the difficulties of operating machinery at very high speeds is to get the rotating parts perfectly balanced, so that they will run smoothly without shaking. Wheels and other revolving pieces of machinery are usually balanced by laying the shaft on which they are mounted on two smooth and level rails, so that the wheel and shaft may roll over on the rails readily, allowing the heavy portion to come to the bottom. By adding the right amount of weight to the rim of the wheel at the top, the wheel may be balanced so that it will lie quiet with any portion of the rim at the top, that is, it will remain in any position to which it is turned and brought to rest. This produces what is known as a "static balance," and for most machinery it is of sufficient accuracy for practical use. This method is accurate within its limits only for wheels or discs which do not have much length along the shaft. The rotating part of an electric generator usually has considerable length along the shaft, the length being frequently greater than the diameter. Such a mass cannot be balanced perfectly standing still, since an irregularity in the balance on one end of the cylinder may be offset by a corresponding irregularity on the other end of the cylinder, so that while it is apparently in perfect equilibrium, it may not run smoothly. If two or more wheels are mounted on one shaft, it is necessary to balance each wheel by itself before putting them on the permanent shaft.

In building up rotors of turbine generators we frequently build them up in sections or discs a few inches in length, and balance each section before they are all placed together to form a cylinder. In order to have such structures rotate without vibration, they must be balanced by a running balance. We must determine how much weight is necessary at each end and where it must be located when the part is rotating. This work is done by means of balancing machines. These are very ingenious machines that have been devised during the last few years, especially for manufacturing parts to be used on steam turbines and on machinery driven by steam turbines. The balancing by these machines depends on a principle that is not very well known except by persons actually engaged in the work of designing or building high speed machinery. This principle is that a revolving body tends to rotate around its center of gravity, and if allowed to turn about this point, it will run smoothly. The behavior of a body rotating around its center of gravity is familiar to all of us in the spinning of a top when it has "gone to sleep." A spinning top is said to have "gone to sleep" when after it has started to spin it has made a few gyrations and has settled down so that it seems almost motionless. By taking advantage of this principle it is possible to locate very accurately just where weights must be added on a rotating body, and by a few trials, the correct amount, so that such bodies can be made to rotate without vibration, at very high speeds. All parts must be made rigid and solid, and every precaution must be taken so that parts will not become displaced while running.

This brings us to another very interesting phenomenon in connection with high speed machinery that is of sufficient importance to be studied. It is what is known as "critical speed" of a revolving structure. Perhaps I can convey some idea of what we mean by "critical speed." It is well known to engineers and musicians that a string stretched between two supports, or a reed or a metal rod if supported firmly at the ends, or at one end, will vibrate at a definite pitch or rate if the unsupported portion is displaced and allowed to move freely on returning. The steel shaft on which the revolving part of a machine is mounted, may be regarded as a reed supported at both ends, and it will behave like a reed if it is set into vibration, that is, it will vibrate at a definite rate. It is well known that a vibrating reed may be made to vibrate farther, although not more rapidly, by repeating impulses on the reed. Vibrations at any other rate cause a discord and tend to check the vibrations in any given reed. The pitch of a shaft, that is, the number of vibrations that it will respond to, is usually large—perhaps from 2000 to 3000 per minute. If now, an unbalanced wheel is mounted on a shaft and run at a low speed, it does not tend to set up vibrations in the shaft corresponding to its pitch; but, as the speed increases, there may be a time at which the speed, that is, the number of revolutions of the shaft, occurs as often per minute as the natural period of vibration of the shaft regarded as a reed. Under this condition the shaft will respond to the impulses caused by the turning of the unbalanced wheel. Each revolution of the shaft increases the amplitude of the vibration of the shaft, and if the speed was maintained at this rate for any length of time, the vibration of the shaft might become serious enough to permanently injure it, or some other parts of the machine. This speed is what is known as the "critical speed." In ordinary machinery this condition is rarely met with, because the pitch of a shaft is usually many times that of the number of revolutions, but on steam turbines and steam turbine generators the speed of the rotating part is such that we frequently run above the critical speed. "Above the critical speed," the revolving part will rotate around its own center and will run particularly smoothly. The revolving part, like the top, might be said to have "gone to sleep"; like the top, to get into this state it must first go through several vibrations, the amount of such vibrations depending on the degree of unbalancing, the stiffness of the shaft and other factors. As there is some danger of injury from the vibrations to the parts in running through the critical speed, as I have tried to point out, it is only under exceptional conditions that machines are run above the critical speed. This can usually be avoided by increasing the stiffness of the shaft, but sometimes the limitations of the designs are such that this cannot be done.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Electricity in the Sawmill

The lumber mill as a power consumer has long been a will-o'-the-wisp to the electric plant in search of a load. The old millman argues that his waste wood is good fuel for a steam plant whose engine runs the mill, only a few of the more progressive recognizing the advantages of an intermediary electric equipment. The greater flexibility of operation, the increased output and the reduced fire hazard are well illustrated in the Potlatch Lumber Company's plant as described in this issue. They fully compensate for the extra cost of electrical apparatus as compared with the old-fashioned drives, especially as an electrically-driven mill is often insurable if the power plant is isolated from the mill.

The obvious benefits to be derived from such an isolated plant suggest the further superiority of transmitted electric power from a hydroelectric plant. Assuming that the fuel cost is nil, the charges for depreciation, maintenance, interest and attendance of a steam power plant are seldom less than .007 cents per kw.-hour. Power can be supplied at this price or lower to many mills who could thus obviate not only the first cost of installation and the subsequent wages, but also all near-by fire hazards. The resulting benefits to the mill and to the power plant are mutual.

Loaded Phantom Circuit

While three New Yorkers telephoned to three Denverites last week, eight Chicagoans were also simultaneously telegraphing to eight New Yorkers over the same two circuits. While duplex telegraphy has been employed for more than a generation and while it has long been possible to telephone over wires transmitting telegraph messages, this feat sets a new record for long distance telephony. Incidentally it is also significant of an early solution of the problem of telephoning 3000 miles from the Atlantic to the Pacific which will mark the signal culmination of years of patient effort on the part of the telephone engineer. Another ideal is made real when longinquity may thus instantly become propinquity.

The modern magic carpet by which this marvel has been wrought is the loaded phantom circuit "Loading" consists in distributing inductance coils along the line to reduce the attenuation of the electric impulse and thus make telephony possible over greater distances. In "phantoming," three telephone sets are connected in parallel over two circuits properly paired and transposed so that non-interfering communication may be held. In this manner four wires can be made to do the work of six.

While both loaded and phantom circuits have been successful singly, it is but recently that a loading coil has been devised which can be applied to a phantom circuit. The combination gives a greater range of transmission than is possible with a loaded physical circuit and thus extends the sphere of long distance telephony.

Common Sense In Contracts

The proposal for an electric lighting system in the Society Islands, as printed elsewhere in this issue, has been the source of no little amusement to several engineers who are sticklers as to the form of engineering contracts and specifications. We are not informed whether the author of this literary engineering oddity is fully posted on the law of contracts, but he certainly exhibits great commonsense in presenting his proposition to the untutored minds of the Mayor of Papeete and his counselors. There can be no doubt as to what he intends to do and how he proposes to do it. As much cannot always be said of some contracts we have read. Furthermore, it landed the job.

Low Head Hydraulic Development

Our Eastern visitors often ask why the low-head power possibilities of the West are not developed. The great rivers of Washington, Oregon and California, with their large flow and swift current, resemble Eastern power sources and seem to offer fewer difficulties than do the high-head streams. The Columbia and the Sacramento, together with their tributaries, and many other smaller streams more remote from power markets, or having less constant flow, have an even grade and a slight fall per mile. There are a number of sites where dams might be erected and power devoleped, but a brief calculation shows that the ratio of cost to power available is out of all proportion to that of high-head developments higher in the mountains.

In the Northwest there have been several successful low-head developments for irrigation purposes, but in California the only example of any size, the 3700-kilowatt Folsom plant, is inoperative during the summer low-water period of the American River. Their massive headworks and frequently long canals are more costly than many undeveloped high-head possibilities which long-distance transmission renders available.

High Tension Automobile Ignition

The development of the gas engine has made possible a prime mover of relatively high efficiency, indispensable to many industries. Its remarkable refinements since the introduction of automobiles and power boats well exemplifying that "necessity is the mother of invention," and have made possible the use of heavier-than-air flying machines.

Were it not for the electric spark the clumsy ignition schemes of the earlier gas engines might still be in use. The low tension make-and-break spark, long used as the only dependable means of igniting the compressed charge of hyro-carbon gas, has now almost been displaced by the high tension jump spark system, due to its simplicity and notwithstanding its uncertain operation. The indifferent success of the low tension magneto as a substitute for primary or secondary batteries brought about the high-tension magneto.

Good results are obtained with the Jump-spark if all parts of the apparatus are in working order, but there are several points between the battery and the plug where troubles may be experienced, from the exhaustion of the battery to the smutting of the spark points. In this system a low tension current supplied to the primary winding of an induction coil is made to oscillate through a make-and-break vibrator, actuated by the iron core of the coil. A pulsating high tension current is supplied from the secondary winding to the leads which pass to the opposite sides of the spark plugs. A condenser placed across this line so amplifies the discharge between the spark points as to give sufficient heat to ignite the mixture. The string of sparks delivered are not hot enough to ignite the mixture instantly, but there is a time element, both in the delivery of the spark and the ignition, which necessitates that starting of the spark must be advanced ahead of the actual time that it is desired the explosion shall take place. The more rapid the explosions, the greater must be this advance.

In the development of the magneto to simplify the jump spark system, it was aimed to make the action as nearly automatic as possible, to eliminate weak points and to supply a spark of sufficient rapidity and heat to ignite the charge almost instantaneously.

Until recently little was known about the design of induction coils and magnetos to obtain the best results and at the same time be automatic, fool-proof and durable under the severe conditions found in automobile work. Many clever devices have been developed and put to use, but the practice as first aimed at seems to prevail. The high tension magneto has an "H" armature with a single fine wire winding of many turns and generates a high electromotive force. This is connected to a revolving condenser on which is mounted a make-and-break switch. The e. m. f. is momentarily generated as the armature breaks the magnetic continuity between the pole pieces and for this reason the armature speed does not affect the current generated, except as the increase of speed increases the impulses of e.m. f. The condenser switch operating in synchronism with the revolutions of the armature, opens at the proper time to discharge the condenser through the line connected to the proper spark plug, the distribution being accomplished through a system of brushes or a distributer. The magneto is driven through gears by the engine shaft and the whole may be connected as a unit, affording the utmost simplicity and compactness. The spark from the power driven magneto occurs at exactly the time that the explosion is desired and being hotter than the ordinary battery jump spark, causes a more complete as well as a quicker ignition with a resulting greater efficiency in the engine or more power delivered to the shaft.

But this is not the only advantage, the spark being almost instantaneous, and its point of generation being in synchronism with the speed of rotation, there is practically no limit to the speed, from the electrical point of view, at which the engine may be operated. There are variations in this construction, for instance, one magneto has a stationary armature, and between the armature and the pole faces is an oscillating iron shield, which, varying the flux between the poles, causes the generating of electro-motive force as before. While electricity has made the light gas engine possible, the refinement in the form of the high tension magneto has permitted improvements which were undreamed a decade ago, and these improvements have made the airship a reality.

PERSONALS.

E. J. de Sabla is making an extensive tour of Europe with his family.

A. R. Maujer, associate editor of "Power," of New York, is a San Francisco visitor.

Leon Bly, secretary of the Tehama Light & Power Company of Red Bluff, recently visited San Francisco.

Charles L. Stamps, Jr., a gas appliance manufacturer of Los Angeles, recently paid a visit to San Francisco.

John A. Shackleford has been elected president of Tacoma Railway and Power Company of Tacoma, Wash.

August Herrmann, who is interested in the Cincinnati Gas, Coal, Coke & Mining Company, is a San Francisco visitor.

F. F. Skeel, manager of Crouse-Hinds Company, is at Los Angeles for a week and will return East via San Francisco.

W. S. Heger, manager for the Allis-Chalmers Company in California, spent the past week at his Los Angeles office.

H. R. Noack, general manager of Pierson, Roeding & Co., is making a trip to New York and the Eastern manufacturing centers.

A. M. Erwin, treasurer of the Westinghouse Electric & Manufacturing Company, has arrived at the San Francisco office from Pittsburg.

H. F. Dodge, division commercial superintendent of the Western Union Telegraph Company, has returned to his San Francisco office, after a tour of the Pacific Northwest.

Wallace W. Briggs, manager of the Westinghouse Electric & Manufacturing Company's district agency with headquarters at San Francisco, left last week for East Pittsburg.

C. D. Heise, of the sales department of the Westinghouse Electric & Manufacturing Company, has returned to San Francisco after paying a visit to the works at East Pittsbrug.

Rudolph W. Van Norden is in the mountains of Lake County, California, on engineering work for the Clear Lake Power & Irrigation Company, for which he is consulting engineer.

A. A. Serva, sales manager of the Fort Wayne Electric Works, is at San Francisco, where he will spend some time with George I. Kinney, manager of the Pacific Coast branch office.

H. A. Lardner, manager of the Pacific Coast office of J. G. White Co., of New York, spent the past week in Southern California looking over the electrical construction work which the firm has in hand.

F. I. Annabel, formerly general superintendent of the Arizona and Swansea Railroad at Swansea, Ariz., has been appointed assistant superintendent of the northern division of the Pacific Electric Railway at Los Angeles.

Rodrick J. McHugh, formerly a branch manager of the Kellogg Switchboard & Supply Company, and later connected with the Arizona Telephone Company, was at Los Angeles last week. He now represents the Hughes Electric Heating Company on the Pacific Coast.

George R. Field, assistant general manager of the Great Western Power Company, has resigned, to take effect July 1. This follows the resignation of H. H. Sinclair as general manager of the same company, announced in a recent issue, Mr. Field having decided on this action at the same time. Mr. Sinclair and Mr. Field will probably retain a connection with the company in its large construction work contemplated on the Feather River, as the plans for this work were prepared by them, and it is understood to be the desire of the officials of the company that the actual work should be done under their direction. In addition to his other duties Mr. Field has had the general direction of the construction work of the company for the past two years, including the large concrete dam at Big Bend, Feather River, finished last November.

Newly elected members of the American Institute of Electrical Engineers include H. A. Barre, electrical engineer, Electric Operating Construction Co., Los Angeles, Cal.; H. S. Buchanan, station superintendent, Telluride Power Co., Provo, Utah; J. B. Butler, construction engineer, Northern California Power Co., Balls Ferry, Cal.; J. E. N. Carpenter, electrician. Pacific Gas & Electric Co., Sacramento, Cal.; W. C. Campbell, engineering department, General Electric Co., San Francisco, Cal.; W. O. Crooks, electrician, Northwestern Improvement Co., Cle Elum, Wash.; I. F. Dix, division plant engineer, Pacific T. & T. Co., Los Angeles, Cal.; B. G. Flaherty, electrician, Northwestern Improvement Co., Cle Elum, Wash.; F. H. Fowler, assistant chief engineer, U. S. Forest Service, San Francisco, Cal.; J. A. Gregory, manager record department, Home Telephone Co., Los Angeles, Cal.; J. A. Harris, chief operator Great Western Power Co., Oakland, Cal.; O. B. Helt, sales agent, General Electric Co., Portland, Ore.; John Hood, engineering department, General Electric Co., San Francisco, Cal.; J. M. Hungate, superintendent of sub-stations Spokane & Inland Emprise Railway Co., Spokane, Wash.; J. C. Jones, salesman Westinghouse Electric & Manufacturing Co., Salt Lake City, Utah; S. J. Keese, district manager, Westinghouse Electric & Manufacturing Co., Los Angeles, Cal.; G. L. Larson, assistant professor of mechanical engineering, University of Idaho, Moscow, Idaho; J. S. La Sha, chief of engineering department, San Diego Consolidated Gas & Electric Co., San Diego, Cal.; R. G. Littler, manager West Coast Engineering Co., Portland, Ore.; Wm. Maddock, superintendent of electrical distribution, Los Angeles Gas & Electric Corporation, Los Angeles, Cal.; W. L. Miller, superintendent United Missouri River Power Co., Helena, Mont.; A. A. R. Perrine, instructor of electrical engineering, Montana State College, Bozeman, Mont.; F. C. Piatt, underground electric distribution department, Oakland Gas, Light & Heat Co., Oakland, Cal.; C. O. Smith, station operator, Los Angeles Pacific Co., Los Angeles, Cal.; J. L. R. Wood, manager Albany Iron Works, Albany, Ore.; D. D. Wright, salesman, Wagner Electric Manufacturing Co., San Francisco, Cal

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TRADE NOTES.

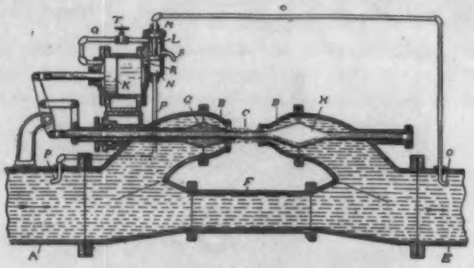
The Fort Wayne Electric Works secured the contract for the transformer work in connection with the large hydro-electric development for the city of Tacoma, Wash., on the Nisqually River. Both power-station and substation transformers for the 30,000-kw. installation are included in the contract.

The Pelton Water Wheel Company of San Francisco has been awarded the contract for the impulse wheels for new installation of the Mother Lode Mining Company in British Columbia. About nine wheels, varying from 10 h.p. up to 400 h.p. each, will be installed to operate under an effective head of about 640 feet. Each generator air compressor and other unit in connection with the running works, will have its individual water wheel, adapted to the class of service desired.

The General Electric Company recently issued bulletins describing its Type F. Oil Switches. Bulletin No. 4821 deals with switches for use on circuits, the voltage of which does not exceed 15,000, and No. 4823 refers to switches designed for voltages of from 22,000 to 110,000. These switches are adapted to the requirements of modern stations employing these switches. They are top connected and are, therefore, adapted to overhead station wiring. There is a double break for each pole and the break takes place in oil. These switches can be fitted with either hand operated or solenoid operated mechanism.

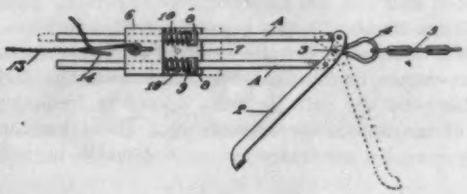
PATENTS

991,624. Safety Device for Hydraulic Systems. Leopold M. Karnasch, San Francisco, Cal. A safety device for a pipe line comprising a by-pass for a short length of the line, the by-pass being divided into two sections, the ends of the sections



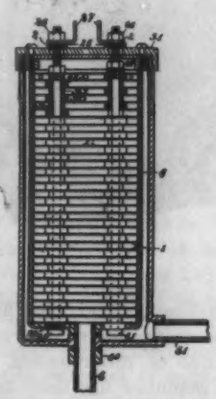
being provided with nozzles, spaced apart and facing each other and needle valves in the nozzles operated by a variation in pressure in the pipe line to varry the size of the nozzle openings.

991,965. Wire-Tightener. Jesse Flint, Cool, Cal., assignor of one-half to George E. Lukens, East Auburn, Cal. The combination in a wire tightener, of a lever having a fulcrum, two rods pivoted to the lever on each side of the fulcrum, a carriage slidable on the rods, said carriage comprising a plate



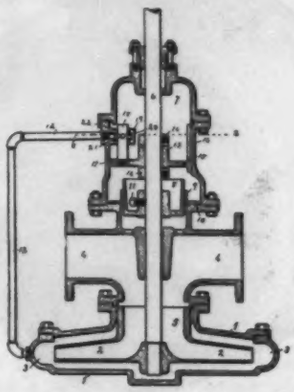
with bent perforated flanges through which the rods pass, and said plate having a perforated platform extension, perforated gripping bars through which said rods pass, said bars loosely fitting the perforations in said platform extension, and springs acting against the carriage and gripping bars to prevent the latter gripping said rods on the return stroke.

991,877. Electrical Liquid-Heater. Andrew P. Nichols, Seattle, Wash., assignor to Central Manufacturing Company, Seattle, Wash. In an electric liquid heater, in combination,



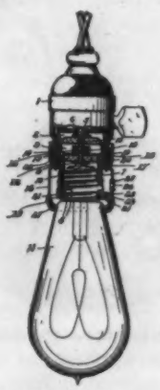
a superposed series of conductive plates spaced apart, and having an insulating covering upon one side, said plates being arranged with like surfaces of successive plates opposed and having openings permitting passage of the liquid successively through the spaces between said plates, and means for connecting alternate plates with opposite poles of an electric generator.

992,005. Balancing Device for Thrust-Bearings. Carl A. Krogh, San Francisco, Cal. In a centrifugal pump, in combination with the impeller and its shaft, a pressure chamber surrounding the shaft, a hollow piston adjustably connected to said shaft and having one side exposed to the pressure in said chamber and on its other side to the suction of the



pump, and a surrounding packing ring resting upon a seat in said chamber, a loose collar mounted on said shaft above said piston, provided with a projecting arm and a valve in said chamber mounted on said arm and moved by the longitudinal movement of said shaft, and operative to open and close a communication between said chamber and the source of pressure.

992,084. Incandescent Lamp Lock. Charles W. Trulock, Los Angeles, Cal. An incandescent lamp lock comprising a swivel plug socket consisting of a plug member and a socket member each having a central terminal, lugs carried by said socket member, said plug member being adapted to be connected with a lamp socket, an incandescent lamp, adapted to be



connected with said locket member, a collar having connection at one end with said lamp socket and adapted to conceal said adapter, and means carried by said collar adapted to be actuated by a key to engage one of said lugs to hold said socket member stationary to enable the connection with or removal of the incandescent lamp socket from said socket member.

INDUSTRIAL

SWITCHBOARD FREQUENCY METERS.

The accurate adjustment of frequency is of great economic importance, and, therefore, it is highly desirable to be able to measure frequency directly. There are several forms of frequency meters on the market, but none meets all of the requirements of general switchboard service. The Weston Electrical Instrument Company of Newark, N. J., has developed a new type of frequency meter which they claim meets every requirement of switchboard service.

Fig. 1. Front View Frequency Meter.

The device consists of a combination of resistors and reactors connected to a differential meter which is arranged to indicate frequency. The circuits are shown in Fig. 3. They form a sort of Wheatstone bridge arrangement. One side of the bridge consists of a resistor, the coils of the instrument and a reactor all in series, and the other side consists of a reactor and resistor. The whole combination is connected in series with a reactor across the line, and then a short connection, A, is made from a point between the two coils and a point between the resistor and the reactor on the other side of the bridge.

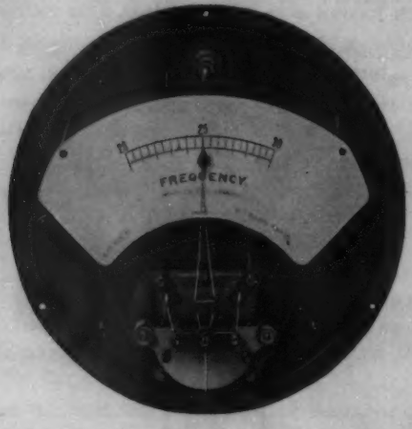


Fig. 2. Interior View Frequency Meter.

The constants of the circuits are so adjusted that there will be no difference of potential across the lead A at normal frequency, then when the frequency departs from normal, the reactance will change and cause more current to be established through one coil and less through the other, the difference being carried by the lead A.

The indicating instrument is a soft-iron type meter with two field coils. These coils are wound flat and slipped one inside the other with their magnetic axes in space quadrature. The working field is the resultant of these two quadrature components, and, therefore, its space position depends entirely upon the relative value of the two component fields. Within the field coils there is situated an iron needle mounted on a pivoted staff and left perfectly free to rotate. This needle always aligns itself with the resultant field, and since the resultant field occupies a definite position for every combination of current values in the field coils, and since the division of current between the coils depends upon the frequency, each position of the needle corresponds to a given frequency and the scale may be calibrated to read directly in cycles per second.

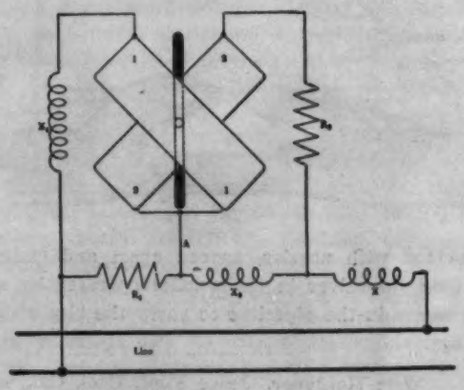


Fig. 3. Circuit Diagram.

By properly choosing the constants of the circuits and suitably designing the indicating instrument, the scale has been rendered uniform and open throughout its entire range and therefore readings may be made from a distance based upon the general position of the pointer with reference to the scale as a whole.

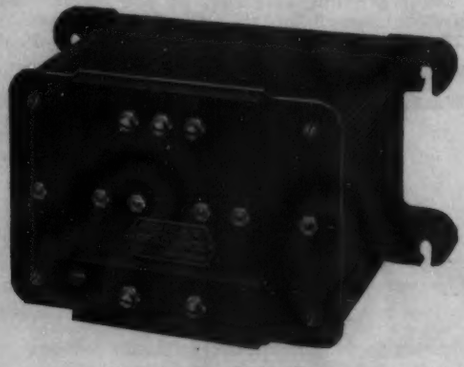


Fig. 4. Auxiliary Box.

A superficial consideration of the theory of this instrument will show that the accuracy is largely dependent upon the proper performance of the reactors. The reactors and resistors, which are mounted together in one auxiliary box, are shown in Fig. 5. As may be seen, the general appearance of the construction is very similar to that of a core-type transformer.

The core material is a special alloy steel having a low hysteretic constant and high permeability. The laminations are made extremely thin and are thoroughly insulated to reduce eddy currents to a minimum. They are firmly bolted together to prevent vibration and loosening of the parts and therewith avoid changes in magnetic reluctance. The air gaps, of which there are two, are made easily and accurately adjustable and by virture of their location, one in the middle of each coil they are shielded by the conductor turns and thus the formation of stray or leakage fields is prevented. Stray fields such as are formed around unshielded air gaps are very objectionable since they vary with the voltage. In the present instance such troubles are practically nil; for example, this frequency meter will indicate the correct value of frequnecy within 1½ per cent between 75 and 150 volts.

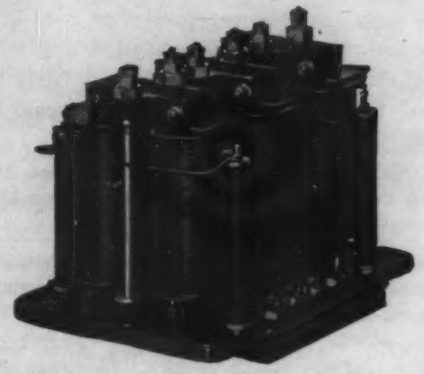


Fig. 5. Reactors and Resistors.

The indications are also independent of any wave distortion which ordinarily occurs in practice, the higher harmonics being damped out by the reactor in series with the device.

The movable system is extremely light and perfectly damped; therefore, it is sensitive and dead beat and will follow accurately every change in frequency.

WOOD STRAIN INSULATORS FOR ELECTRIC LIGHT AND POWER LINE CONSTRUCTION.

It appears to be a prevailing opinion with many electrical construction men that wood strain insulators are properly used only in street railway installations. That this impression is incorrect is evidenced by the volume of orders that is being placed by the manufacturers by exclusive electric lighting and power companies, for strain insulators of this type.

Wood strain insulators are cheaper than composition forms, and are less effected by the action of the weather. Unlike porcelain insulators they are not brittle and they have greater sparking distances. They can be used in guy wires, at dead ends of conductors and in practically any application for which porcelain and composition insulators have been used heretofore.

One feature of the wood strain insulator that renders it particularly desirable for insertion in existing guys is that it can be cut in a guy wire without its being necessary to splice in an additional length of wire. The reason for this is that the wood insulator is relatively long and when one is inserted in a guy wire sufficient slack will result therefrom to form the servings.

Westinghouse wood strain insulators are constructed of specially selected hickory which is impregnated with a waterproof insulating compound and then given two coats of varnish, each of which is baked on. The caps are malleable mild steel pressed around the conical ends of the staffs with powerful hydraulic presses. It is interesting to note that there is a certain angle of pitch for each diameter of insulator that gives maximum holding power. The greater the angle the more the metal will be disturbed in swaging it on the wooden cone and the more it is deformed the weaker it will be. On the other hand, the smaller the angle of pitch the greater is its wedge action tending to open the cap after it has been given a conical form.

Tests demonstrate that when stressed to destruction, 95 per cent of the Westinghouse wood strain insulators will break in the wood. The caps seldom fail first. The average ultimate tensile strength of the 1-inch diameter insulator is 7000 pounds and of the 1¼-inch diameter insulator, 8000 pounds. The average ultimate dielectric strength of insulators measuring 5 in. along the staff between the caps is over 50,000 volts when tested dry. This seemingly excessive insulation is advisable in order that there will be an adequate factor of safety for pressures of 600 volts when the insulation is dirty and wet. Wood strain insulators having an insulating distance of 12 inches are recommended for working voltages of 1000 to 2000. Wood strain insulators having lengths up to 48 inches are manufactured by the Westinghouse Company.

Metal caps, carrying eyes, clevises, or tapped bosses can be furnished. Caps of the same style can be furnished on each of the ends or a cap of one style can be furnished on one end and a cap of a different style on the other end.

A CENTRAL MINE POWER PLANT.

The Victor-American Fuel Company, who own one of the most up-to-date and modern coal mining plants in the Southwest, has been operating steam plants at three of its coal properties near Gallup, New Mexico. A short time ago, it decided to install a central turbine plant, and transmit power from this to its other properties. To this end, the company constructed a fireproof power house built of brick, with steel supported roof in which it is installing one 300 h.p. water tube boiler, and three 100 h.p. marine boilers with Illinois stokers, space being left for additional boilers to be installed later. Steel coal bunkers are provided which receive coal from a table about 200 feet away. The ashes from each boiler fire pot are emptied into a special car underneath the boilers and these cars are run out and the ashes emptied into a pit from which they are conveyed by an aerial tramway to an ash dumping ground some 2000 ft. away.

In the generator room, the present installation will consist of 2 ATB 500 kw. 2300 volt three-phase General Electric horizontal condensing steam turbines operating at a speed of 3600 r.p,m and a frequency of 60 cycles, space being left for two additional units. The exciters will consist of two continuous current 15 kw. 125 volt General Electric condensing turbines operating at a speed of 4500 r.p.m.

The switchboard was purchased from the General Electric Company and will have Vermont blue marble panels and standard finished instruments. It will consist of two 15 kw. d. c. exciter panels, two 500 kw. a. c. turbine panels, and four a. c. single circuit feeder panels, with all necessary instruments, including wattmeters, synchronism indicator and voltage regulator.

There are at present four feeder circuits radiating from the power house. One circuit goes to the Heaton mine, about 1¼ miles distant, where about 300 kw. in motors are installed; another runs in the opposite direction to the company's Navajo mine, where it has approximately 600 kw. in motors; the third circuit goes to the Bartlett mine, about 1½ miles away, where 200 kw. in motors are installed; the fourth circuit goes to the town of Gallup, five or six miles away, where the electricity will be used for lighting and power. A voltage of 6600 was decided upon as a suitable potential for transmission as some of the developments were situated four t. six miles from the plant. All the circuits are protected by General Electric aluminum cell lighting arresters.

NEWS NOTES

INCORPORATIONS.

LAKEPORT, CAL.—The Mt. Konocti Light & Power Company has been incorporated by J. A. Foster, J. L. Davis and J. Hastings.

SAN FRANCISCO, CAL.—The National Illuminating Company has been incorporated for $1,000,000 by S. J. Kenworthy, R. M. Cole, R. M. Barr, G. A. and W. E. Bartlett.

EL MONTE, CAL.—The El Monte Light & Water Company has been incorporated. Directors: A. F. Snell, I. T. Baker, G. H. Coffin, S. Shirpser and M. Kauffman. Capital stock, $25,000. Subscribed, $50.

LOS ANGELES, CAL.—The Central Counties Gas Company of California has been incorporated. Directors: C. S. S. Forney, W. S. McFarland, H. W. Ritz, F. N. Hawes, L. O. Adams, F. E. Miller, R. B. Wheeler, O. B. Hinsdale and J. L. McCalley. Capital stock, $1,000,000. Subscribed, $9.

ILLUMINATION.

ALAMEDA, CAL.—Steps are now being taken to call a bond election in this city which will include $125,000 for the electric light plant.

MADRAS, ORE.—The City Council has passed an ordinance authorizing A. E. Hammond to construct and operate an electric light and power plant in the city of Madras.

LEAVENWORTH, WASH.—An ordinance granting to the Tumwater Light & Water Company a 43-year franchise on all the streets and alleys of this town is now before the City Council.

WAITSBURG, WASH.—The Council has passed an ordinance granting to the Waitsburg Electric Light Company the right to maintain electric light and power lines in the city of Waitsburg.

LOS ANGELES, CAL.—The Board of Supervisors has voted to accept the bid of the Thomas Day Company of San Francisco of $13,360.26 for furnishing electrical fixtures for lighting the Hall of Records.

LOS ANGELES, CAL.—The High School Board of Los Angeles is receiving sealed bids for furnishing labor and material necessary for the electrical work of the Mechanics Building, Hollywood High School.

SEATTLE, WASH.—Mayor George W. Dilling has signed a bill passed authorizing an expenditure of $75,000 for the construction and maintenance of a new power house on Lake Union at the foot of Nelson place.

LEAVENWORTH, WASH.—The Snow Creek Water Company, recently organized and now having the construction of a water system under way, has made application for a franchise to furnish electric current for light and power purposes.

GOLDENDALE, WASH.—The Pacific States Electric Company of Portland has purchased the electric light plant of this city from H. W. Fellows. The price paid was $55,000 cash. The system will be extended and improved by the new owners this spring.

ROSEBURG, ORE.—Fire last week destroyed the Winchester plant of the Roseburg Water & Light Company. The loss is given at $50,000 with $12,000 insurance. Kendall Bros., who own the plant, also maintain a small auxiliary plant in the south part of Roseburg. This will furnish the city with water and light until the plant can be repaired.

LEWISTON, IDAHO.—The franchise sought by the Lewiston Clarkston Improvement Company to supply this city with electrical current for heating, lighting and power purposes has been passed by the City Council, five members voting in favor of the franchise.

TURLOCK, CAL.—Engineer Steele has presented to the City Trustees a written report as to the probable cost of the installation of a municipal gas plant. He advised the Trustees not to raise less than $50,000 for this purpose. He estimated that $35,000 would be sufficient to build a plant that would supply Turlock at the present time.

TRANSMISSION.

SALEM, ORE.—The City Council has voted to purchase the Salem Light & Water & Power Company's plant for approximately $370,000.

VANCOUVER, WASH.—Engineers of the Mount Hood Railway & Power Company are here completing arrangements for the construction of a substation.

PALO CEDRO, CAL.—The Northern California Power Company has built six miles of power lines, north, east, south and west, to accommodate these farmers.

REDDING, CAL.—C. W. Hill has given notice of the appropriation of 300 inches of water to be taken from Bear Creek to be used for the generation of electric power.

SONORA, CAL.—D. H. Steinmitz, general manager of the Standard Company of Sonora, and T. S. Bullock of the Sierra Railway Company have filed on 40,000 inches of water in the north fork of the Tuolumne River.

VANCOUVER, WASH.—The Mount Hood Railway & Power Company has been awarded the contract for furnishing electricity at the U. S. garrison. The other bidder was the Portland Railway, Light & Power Company.

COLUSA, CAL.—The service on the new 60,000 voltage line between this city and Marysville started this week and the service over the old line to Gridley is a thing of the past. The Gridley line will be used as a substitute in case the other line goes out.

SAND POINT, IDAHO.—The town of Hope, East Hope and Clarkfork are after electricity for power and light purposes and the Northern Idaho & Montana Power Company is making estimates upon the cost of extending its power line from here and if the business in sight will warrant the expenditure.

SAN FRANCISCO, CAL.—A local financial deal just announced is the sale of $1,000,000 worth of bonds by the Northern California Power Company to N. W. Halsey & Co. The company has an authorized issue of $10,000,000, of which but a small part has been put out. The income from the sale will be devoted to improvements and extensions. The terms of the sale have not been made public.

OROVILLE, CAL.—The Great Western Power Company is soon to start active work on the additional unit to the plant at Las Plumas. S. B. Hutchinson, local labor agent, has been instructed to secure a force of laborers. The men will be set to work building a road on the Las Plumas side of Feather River and erecting a number of cottages and storehouses. There are now four units at the plant and plans have been made for the addition of another unit.

TRANSPORTATION.

OAKLAND, CAL.—The Southern Pacific Company operated its first electric trains on the Alameda system on May 11.

LOS ANGELES, CAL.—The Board of Public Works is receiving sealed bids for furnishing to the city two miles of copper trolley wire.

CHICO, CAL.—The double track franchise on Main street desired by the Northern Electric Railway will be advertised for sale, June 6th having been set by the Board as the date for opening the bids.

SANTA CLARA, CAL.—Manager F. E. Chapin of the Peninsular Railroads states that the company intends to build an electric line from Santa Clara to Meridian Corners and that it will be but a very short time before they will have their plans in shape to ask for a franchise for such road.

CHICO, CAL.—J. B. Rowray, formerly connected with the Pacific Electric Railway Company at Los Angeles, has assumed his new duties with the Northern Electric Company, filling the vacancy caused by the resignation of Melville Dozier, assistant manager and engineer for the company. Rowray has gone over the road several times and is now familiar with it and has secured a general insight into local conditions. He will make his headquarters at Chico.

MONTEREY, CAL.—The Monterey & Pacific Grove Electric Railway will abandon its lines on Decatur street from Alvarado street to Pacific street and on Lighthouse avenue in front of the Presidio gate and run over a private right of way from the end of Alvarado street at the Custom House in a straight line along the Southern Pacific track to a point on its present line on Lighthouse avenue. This is announced by General Manager Davis, who says that a right of way over the Southern Pacific Railroad has been secured and that work on the new construction will commence at once.

LOS ANGELES, CAL.—Operation of the Los Angeles and Redondo Railway and the San Pedro narrow gauge line, as a portion of the southern division of the Pacific Electric Railway, was begun last week in accordance with a circular issued from the office of J. McMillan, general manager of the Pacific Electric. Tracks of the Los Angeles and Redondo and San Pedro line will be broad-gauged, the time for beginning the change not having been announced. Three new officials of divisions of the Pacific Electric, appointed recently, were installed in office, as follows: W. T. Maddox, superintendent of the southern division, succeeding Thomas McCaffery, resigned; J. C. McPherson, superintendent of the northern division, succeeding J. B. Rowray, resigned; F. L. Annable, assistant superintendent of the northern division, succeeding J. C. McPherson, resigned. Offices of the superintendents will be in the Pacific Electric building. Those of the assistant superintendent will be in Pasadena.

TELEGRAPH AND TELEPHONE.

OAKLAND, ORE.—Plans have been adopted for the rebuilding and improvement of the local telephone system.

EUREKA, CAL.—According to a report from Orleans the forest service has surveyed the line for a telephone service as far down the Klamath River as Bluff Creek.

DAVENPORT, WASH.—The lines of the local and long distance telephone company have been sold to the Washington Consolidated Telephone & Telegraph Company of Spokane, at $10,000.

WENATCHEE, WASH.—H. W. Boetzkes of Chelan has filed an application for a franchise to construct a pole line for telephone wires extending from Chelan 14 miles over county roads. It is rumored that the franchise is being secured for the Ellingsworths, who are developing irrigation projects where the proposed line will extend.

SPOKANE, WASH.—The Pacific Telephone & Telegraph Company has made application for a permit for the new exchange which is being erected at the corner of Second avenue and Stevens street.

SAN FRANCISCO, CAL.—The new wage agreement of the electrical workers with the Pacific Telephone & Telegraph Company has been accepted dating May 1, and embracing the States of Washington, Oregon, California and Nevada. The electricians affected will receive an increase in wages amounting to 25 per cent and double time for all overtime.

WATERWORKS.

CORNING, CAL.—Bids for the construction of the new water system for Corning have been opened by the Board of Trustees. The contract was awarded to the Braun, Williams & Russell Company for $40,500.

SAN DIEGO, CAL.—Mayor Wadham in his message to the City Council recommended that the city immediately begin consideration of and preparation for the purchase of the water system of the Southern California Mountain Water Company.

CENTRALIA, WASH.—The Washington-Oregon Corporation, the holding company of the Twin City Light & Traction Company, has presented a franchise ordinance to the City Council for passage which grants to the corporation a 50-year water franchise.

EUREKA, CAL.—W. C. Corbaley, superintendent of the Eureka Water Company, has left for San Francisco where he will secure bids and probably arrange a contract for the building of a water tower in the southern part of the city. The tower is to be 85 feet high and will be built on ground 15 feet higher than the present tanks and will cost at least $30,000.

NEWMAN, CAL.—The Newman Waterworks Company announces its intention to make a number of important improvements in its system at once. The distribution facilities will be bettered by the laying of a new four-inch main through the Postoffice block, from Fresno street to Merced, and a three-inch main from Kern to Yolo street. The total cost will be about $3000.

OAKLAND, CAL.—W. F. Kelly, former general manager of the Oakland Traction Company and the Key Route systems, will become directing engineer and assistant general manager of the People's Water Company if Frank C. Havens, president of the water company, can induce him to accept the position. At the time he tendered his resignation as directing head of the traction lines of Oakland it was rumored that his severance of connections with the Smith interests was due to his close friendship with Havens. Both Messrs. Havens and Kelly decline to discuss the probable association of the latter with the People's Water Company, but both admitted that such an arrangement might be effected within a short time.

BAKERSFIELD, CAL.—C. B. Colby, one of the local oil men interested in the Western Water Company, which is to furnish water for drilling and domestic purposes to the West Side from wells near Rio Bravo, announces that the new company will supply Maricopa. A service line will be constructed from 110,000 barrel storage, to be erected at the Taft station, into the field and town of Maricopa. Work has been begun in putting down another well at Station 1 near Rio Bravo. Operations will be put forward as speedily as possible. Sixty-nine thousand feet of the 12-inch pipe for the main line have been ordered and it will require between 13 and 14 miles of a small sized pipe to install the first service lines. Mr. Colby declares that contracts are being signed up readily and the first capacity of 40,000 barrels will be disposed of long before the line is ready for service.

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Aluminum Co. of America
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American Circular Loom Co.
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